Project H-3: Sodium borohydride as a hydrogen storage material

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Production and reprocessing of sodium borohydride

A new production process of sodium borohydride ($NaBH_4$) as a hydrogen storage material was developed by using sodium metaborate ($NaBO_2$) in which a simple reaction given as $NaBO_2 + 2Mg + 2H_2 \rightarrow NaBH_4 + 2MgO$ took place at a considerably high reaction rate by changing the system temperature dynamically.

The process applies the transitional state of hydrogen at the extreme surface of Mg when it is hydrogenated and dehydrogenated under the constant rate of temperature change, *dT/dt* ($^oC/s$). The rate of temperature change is equivalent to the rate of thermal energy input to the system. MgH_2 was not detected during the transitional temperature changes.

The rate of conversion is found to be significantly dependent on *dT/dt* and regulated by the oxidation level of Mg particles. MgO formed in exchange with the formation of $NaBH_4$ was limited to the surface layer and it was found to be significantly influential on the conversion rate. However, Conversion reached 70 to 80%, depending on the rate of thermal input. The particle size effect has been investigated and will be reported in 2004.

The roles of protide (H^- hydride ion) that exists in the form *Mg•2(H⁻)* in $Mg + H_2 \rightarrow MgH_2 \rightarrow Mg•2(H^-)$ during transitional conditions will be evaluated in detail in the next stage of Task 17 work, especially with regard to the exchange reaction between $NaBO_2$ and $NaBH_4$.

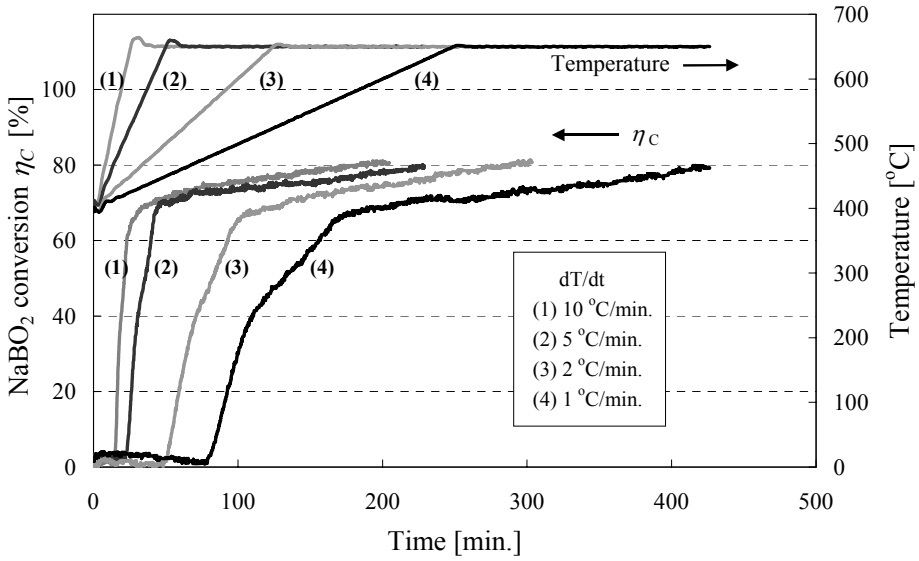

Figure 1. $NaBO_2$ Conversion rate as a function of *dT/dt*, the rate of temperature raise